

## THE EFFECT OF GROWTH RETARDANTS ON GROWTH, FLOWERING AND YIELD OF AFRICAN MARIGOLD (*TAGETES ERECTA* L.)

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### ABSTRACT

*Cycocel and maleic hydrazide at 0, 500 and 1000 ppm were applied to study its effects on growth, floral characters, yield and seed parameters. Various growth parameters i. e. number of branches, fresh and dry weight of plant were significantly increased when the plants were sprayed with 500 ppm of cycocel or maleic hydrazide. Plant height and internodal length decreased with the increasing concentrations of cycocel and maleic hydrazide. Interactions were significant in all the growth parameters except internodal length. It was interesting to note the detrimental effects of these chemicals when applied in combination at higher concentrations. Maximum number of buds per plant were observed when the plants were sprayed separately with cycocel 1000 ppm and MH 500 ppm. Maleic hydrazide at 500 ppm significantly affected days to flowering and duration of flowering, whereas, the results were non-significant with cycocel application. The combined application of MH and CCC significantly favoured days to flowering and duration of flowering. Cycocel at 1000 ppm along with MH at 500 ppm had significantly higher fresh and dry weight, number of flowers, flower yield per plant and flower yield per hectare.*

**KEYWORDS:** African Marigold, Cycocel & Maleic Hydrazide

**Received:** Apr 01, 2019; **Accepted:** Apr 20, 2019; **Published:** May 06, 2019; **Paper Id.:** IJASRJUN201919

### INTRODUCTION

There is a tremendous scope of improvement in agro-technology of flower crops. A wealth of data can be generated for better understanding and better quality of flowers. There are various factors which are responsible for higher production of marigold viz., variety, time of planting, fertilizer application, spacing, cultural practices like pinching, use of plant growth substances, irrigation etc. Therefore, the present investigation was planned and undertaken with the objective to study the effect of growth retardants on growth, flowering and yield (flower and seed) of African marigold.

### MATERIAL AND METHODS

The present investigation was carried out at the Department of Horticulture, CCS Haryana Agricultural University, Hisar, India for two years, during 2004 and 2005. The experiment was laid out in a factorial randomized block design with three replications. There were 15 treatment viz. five levels of nitrogen (0,10,20,30 and 40 g/m<sup>2</sup>) and three levels of phosphorus (0,10, and 20 g/m<sup>2</sup>) with a single constant level of potassium 10 g/m<sup>2</sup> along with 10 kg/plot(1.2 m x 1.2 m) farm yard manure (FYM). The full dose of FYM, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and half of N were applied as basal dressing and remaining half of nitrogen was applied 30 days after transplanting. One month old seedlings of almost equal size and vigour were transplanted in the plots of size having 1.20 m x 1.20 m at a spacing of 40 cm x 40 cm. Marigold plants were treated once with three different levels (0, 500 and 1000 ppm) each of

Cycocel (CCC) and Maleic Hydrazide (MH) four week after transplanting.

## RESULTS AND DISCUSSIONS

### Growth Parameters

The major areas where plant growth regulators used in floriculture are plant propagation, plant canopy management, regulation of flowering and prolonging the shelf life of cut blooms besides some other minor uses. A good work has been done regarding the role of plant growth regulators in controlling plant height. Growth retardants not only reduce the plant height but helps the floriculturists to maintain plants of various sizes and shapes. Marigolds are excellent plants, especially the cultivars of *Tagetes patula* and *Tagetes tenuifolia* are grown in pots for window garden, varandas and other situations. The cultivars of *Tagetes erecta* usually grow taller and growth-retarding chemicals have been recommended for reducing the height of plants. This experiment was carried out to study the effect of cycocel and maleic hydrazide on growth, flowering and yield of African marigold. Effect from CCC and MH when used at a concentration of 500 and 1000 ppm alone and in combination significantly decreased plant height and internodal length, increased plant spread, number of branches, fresh and dry weight of the maximum decrease in plant height was observed when CCC and MH were used alone at a concentration of 1000 ppm. Cycocel and MH probably interfered with the metabolic activities of the plants by intercepting nutrient assimilation and growth. Parmar and Singh (1983) and Syamal *et al.* (1990) in marigold reported similar results. Reddy (1988) reported significant reduction in internodal length and decreased number of branches in China aster with the application of MH when used at a concentration of 750 and 1000 ppm. Narayan Gowda and Jayanthi (1991) also reported similar results with increased concentration CCC and MH. Maire and Sachas (1967) reported that free sugars normally utilized to sustain growth were polymerized in the presence of these compounds to form storage carbohydrates and thus retard the rate of plant growth. The antiauxin activity disturbed carbohydrate metabolism and inhibition of cell division and elongation of apical meristem might contribute to growth and shortening of internodes to the plants treated with MH and CCC (Cathey, 1964; Sen and Sen, 1968).

**Table 1: The Effect of Cycocel and Maleic Hydrazide on Growth Parameters in African Marigold**

	Plant Height (cm)		Plant Spread (cm)		Number of Branches per Plant		Internodal Length (cm)		Fresh Weight of Plant (g)		Dry Weight of Plant (g)		Flower Yield per Hectare (t)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
C 0	48.7	56.3	31.1	35.9	16.9	16.8	2.84	2.94	493.7	570.5	45.5	52.6	23.7	27.2
C 500	47.8	54.4	33.1	37.0	18.4	18.0	2.48	2.58	567.3	636.8	53.5	60.4	26.2	29.1
C 1000	44.2	48.9	35.6	38.6	18.6	17.9	2.26	2.24	574.3	623.5	55.6	60.4	27.6	29.8
MH 0	51.0	57.8	35.4	39.9	18.3	18.0	2.86	2.92	558.6	629.5	52.8	59.5	27.2	30.8
MH 500	47.0	54.0	38.2	42.6	19.9	19.5	2.51	2.58	604.6	674.0	57.7	64.3	27.2	32.7
MH 1000	42.6	47.8	26.2	29.0	15.6	15.3	2.21	2.25	472.0	527.3	44.1	49.7	27.2	22.6
Cycocel X Maleic Hydrazide	6.2	7.0	5.6	6.3	2.4	2.3	N.S.	N.S.	72.6	79.3	7.0	7.6	2.7	3.2

### Floral Parameters

Cycocel and MH enhanced the bud initiation with the increasing concentration of cycocel, whereas, MH delayed the bud initiation (Table 2). These results are in contradiction with the results of Parmar and Singh (1983). Duration of flowering increased with both the chemicals. However, results were non-significant when CCC was applied alone. Non-significant increase in flower diameter and stalk length was observed with the increase in concentration of CCC and MH.

The early flowering due to the application of CCC might have been due to the fact that such plants have developed sufficient food reserve at initial stages. These reserved food could have been utilized for the reproductive growth with restriction in vegetative growth, which was evident in the plants treated with CCC. Wittewer and Tolbert (1960) reported promotion of flowering in response to treatment with cycocel and related compounds. Murali and Gowda (1988) observed that cycocel treated jasmine plants came to flowering earlier because of the anti-gibberellin action of cycocel. A reduction in the level of endogenous gibberelin might be a pre-requisite for floral induction that was achieved by cycocel sprays.

**Table 2: Effect of Cycocel and Maleic Hydrazide on Floral Parameters in African Marigold**

	Days to Bud Initiation		Number of Buds per Plant		Days to Flowering		Duration of Flowering		Flower Diameter (cm)		Stalk Length (cm)		Flower Yield per Hectare (t)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
C 0	35.7	37.5	58.1	63.1	50.4	54.8	54.7	59.4	5.92	5.88	6.48	7.04	23.7	27.2
C 500	36.4	38.2	64.2	68.5	52.1	55.6	54.4	58.7	6.29	6.17	6.74	7.19	26.2	29.1
C 1000	36.7	38.1	68.3	72.1	55.2	57.3	53.1	55.5	6.36	6.15	6.90	7.19	27.6	29.8
MH 0	36.6	38.4	66.0	70.6	52.1	55.8	54.8	58.8	6.25	6.15	6.73	7.22	27.2	30.8
MH 500	37.3	38.9	69.5	73.8	57.0	60.6	59.1	62.9	6.49	6.36	6.92	7.36	27.2	32.7
MH 1000	34.9	36.6	55.1	59.2	48.6	51.2	48.3	52.0	5.82	5.69	6.47	6.85	27.2	22.6

#### Yield Parameters

A significant increase in fresh and dry weight of flowers was observed with the increasing concentrations of CCC and MH. Enhancement of flower size might be due to the increase in the length of floret and pedicels accompanied by the increase in their number. The weight of the flower increased due to the increase in the size of flower. According to the Zieslin *et al.* (1974) the enlargement of the flower size is caused by drawing photosynthates to the flower as a consequence of intensification of the sink. Increase in the length of flower stalk might have resulted from increased cell division. Results of the study indicate significantly higher yield of flower both by number and weight per plant over control due to the application of both the chemicals.

The increase in concentration caused progressive increase in the yield of flower (Table 3). Enhanced yield of flower per plant and per hectare is attributed probably due to the production of large number of lateral branches at the early stage, which then had sufficient time to accumulate the assimilates. Similar enhanced yield because of MH and CCC spraying were also reported by Sen and Maharana (1972) and Dutta and Seemanthini (1998) in chrysanthemum, Pappiah and Muthuswamy (1977) in jasmine, and Lal and Mishra (1986) in marigold.

**Table 3: Effect of Cycocel and Maleic Hydrazide on Yield Parameters in African Marigold**

	Average Fresh Weight of Flower (g)		Average Dry Weight of Flower (g)		Number of Flowers per Plant		Flower Yield per Plant (g)		Flower Yield per Hectare (t)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
C 0	7.70	7.66	0.71	0.71	58.8	63.9	441.3	496.4	23.7	27.2
C 500	8.42	8.26	0.80	0.79	60.2	64.1	472.9	515.4	26.2	29.1
C 1000	8.74	8.44	0.86	0.83	60.0	62.6	507.6	537.2	27.6	29.8
MH 0	8.83	8.67	0.83	0.82	60.4	64.7	499.4	541.7	27.2	30.8
MH 500	9.09	8.90	0.87	0.85	61.4	65.3	544.0	592.4	27.2	32.7
MH 1000	6.94	6.79	0.67	0.65	57.3	60.7	378.4	414.9	27.2	22.6
Cycocel X Maleic Hydrazide	1.00	0.99	0.09	0.09	5.0	5.6	71.0	78.9	2.7	3.2

## CONCLUSIONS

Application of cycocel at 1000 ppm and maleic hydrazide at 500 ppm had significant favorable effect on vegetative characters, important floral character (number of flowers, flower diameter) and flower yield.

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